

1/31

Fig.1(A)

Configuration (comparative example)

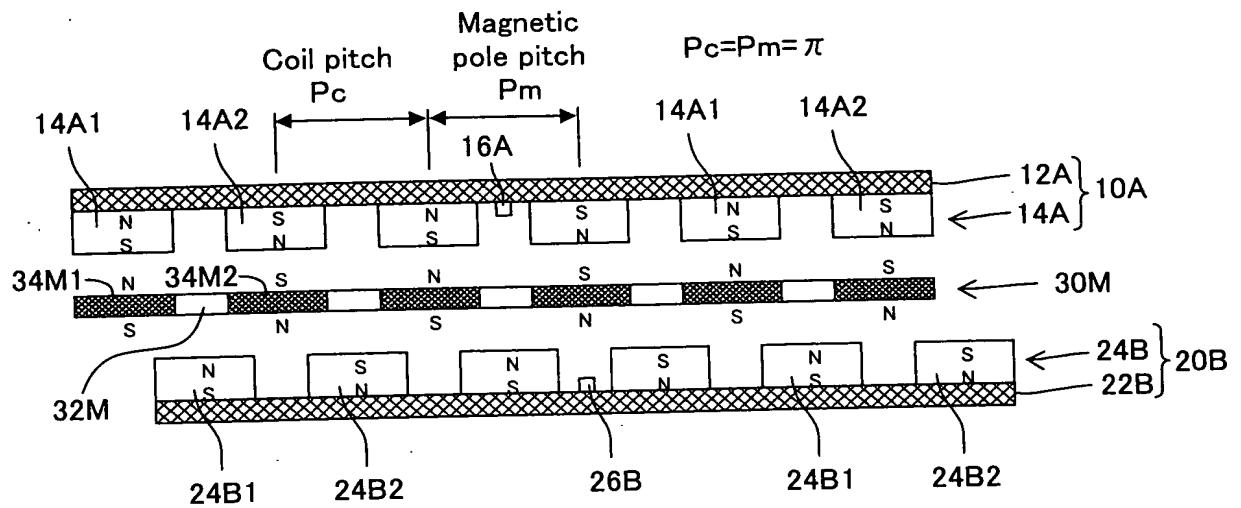
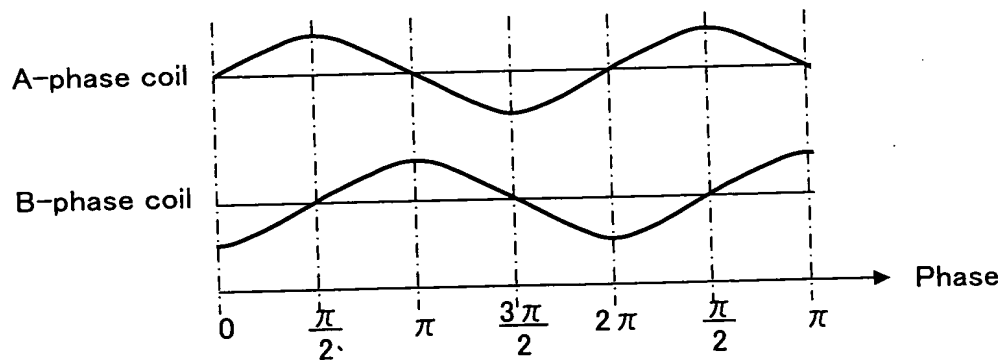


Fig.1(B)

Alternating current drive signals



2/31

Fig.2(A)

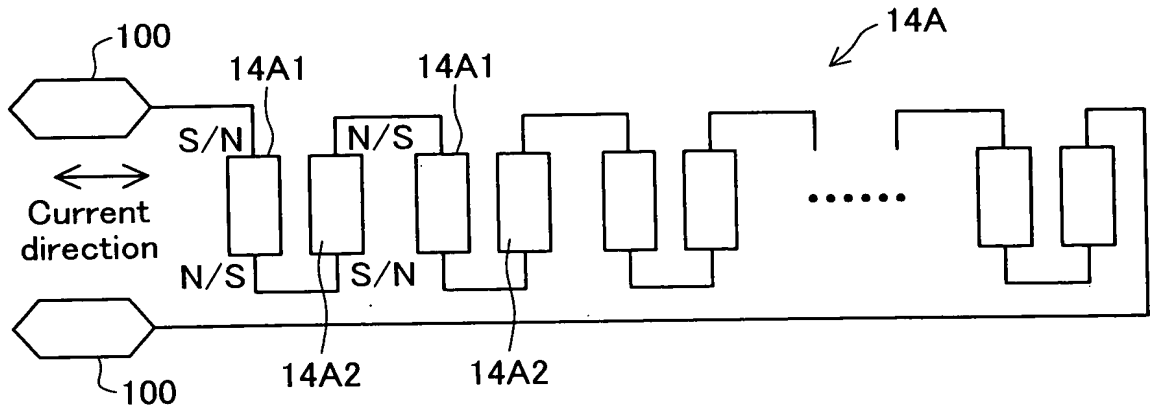
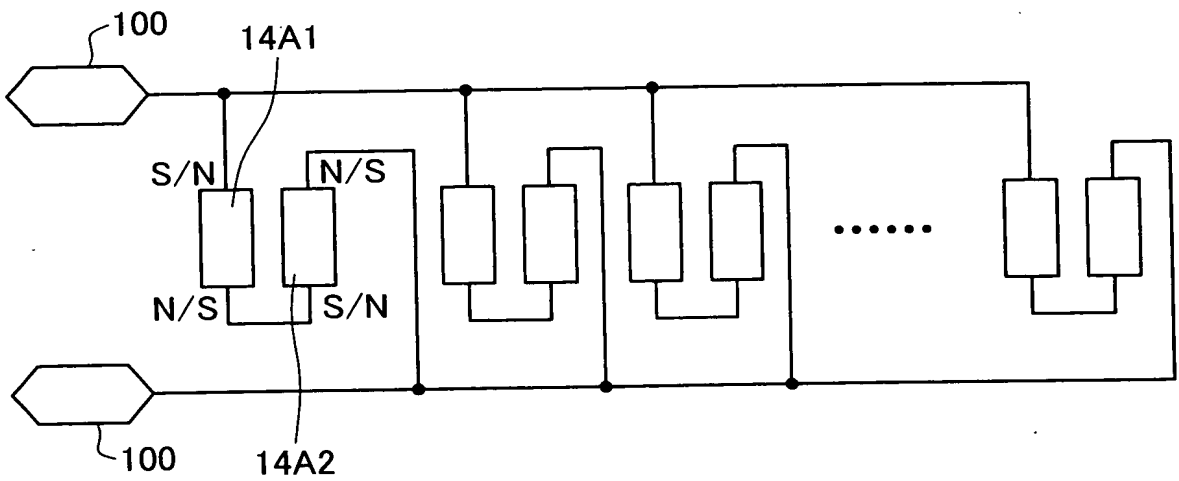


Fig.2(B)



3/31

Fig.3(A)

Comparative example

Immediately before phase = 2π (A-phase has polarity reversed at 2π)

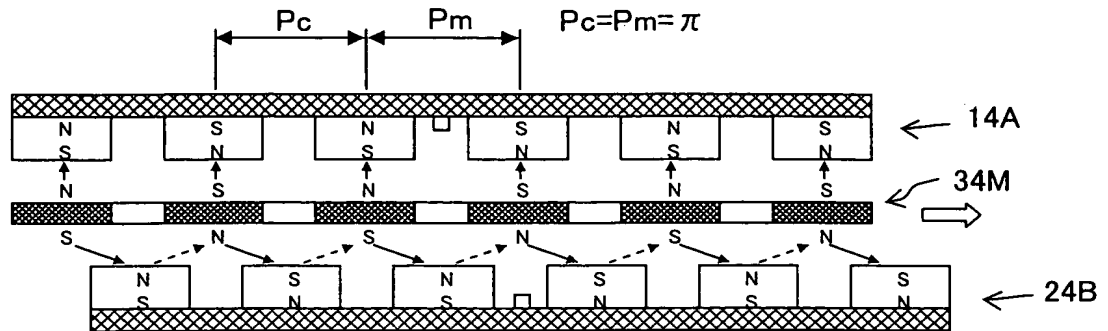


Fig.3(B)

Phase = $\pi/4$

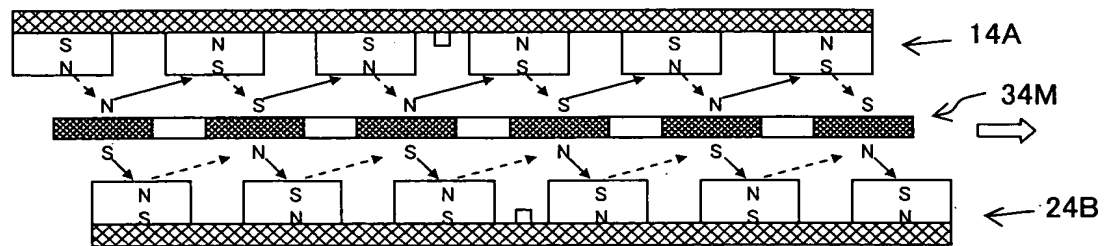


Fig.3(C)

Immediately before phase = $\pi/2$ (B-phase has polarity reversed at $\pi/2$)

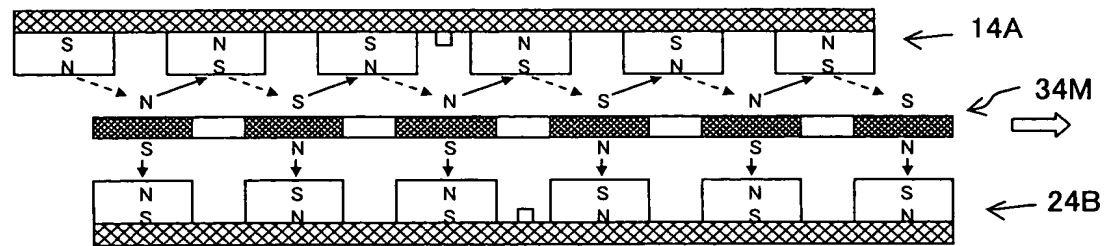
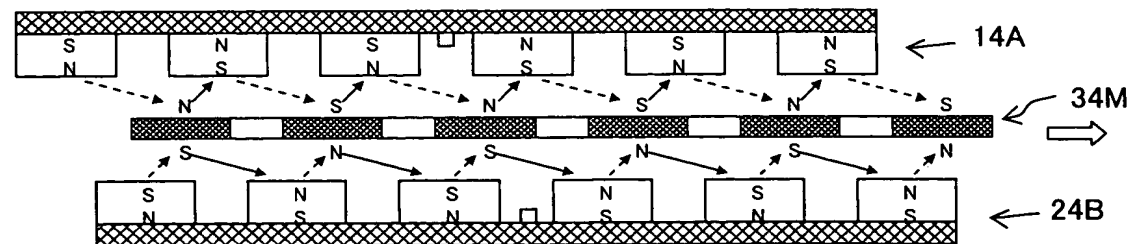


Fig.3(D)

Phase = $3\pi/4$



4/31

Fig.4(A)

First embodiment (two-phase motor)

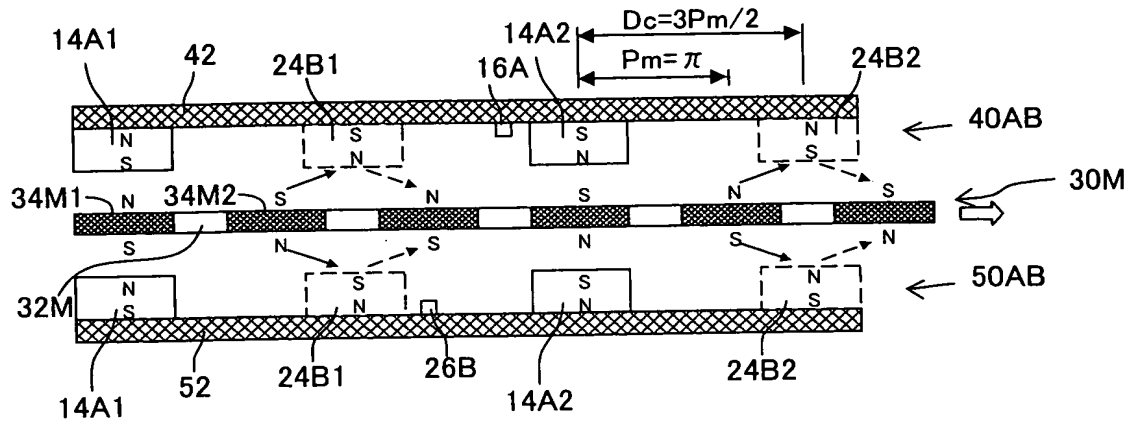
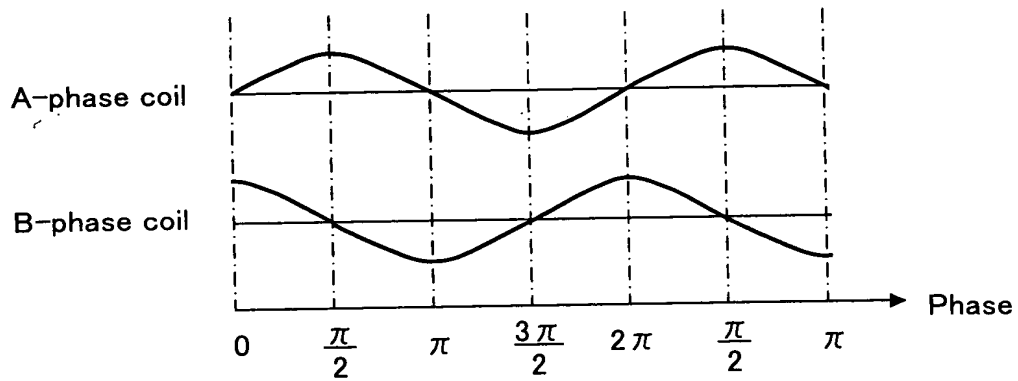


Fig.4(B)

Alternating current drive signals



5/31

Fig.5(A)

First embodiment (two-phase motor)

Immediately before phase = 2π (A-phase has polarity reversed at 2π)

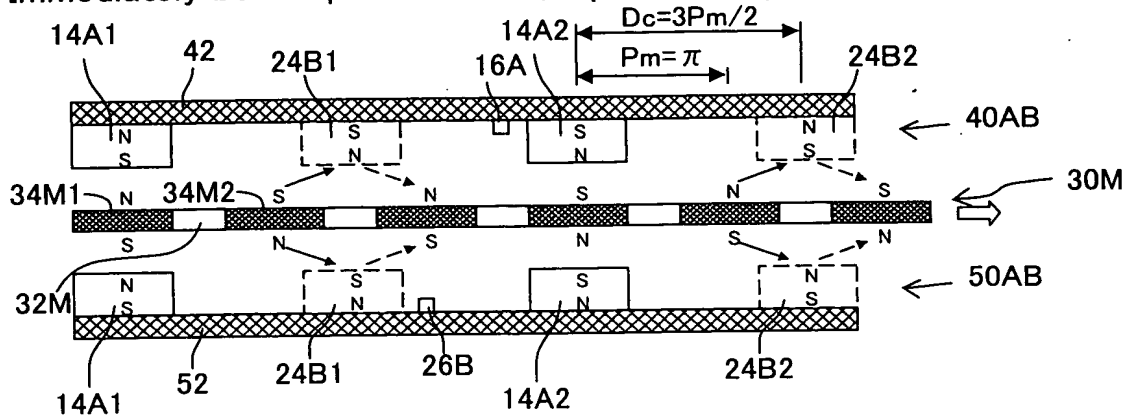


Fig.5(B)

Phase = $\pi/4$

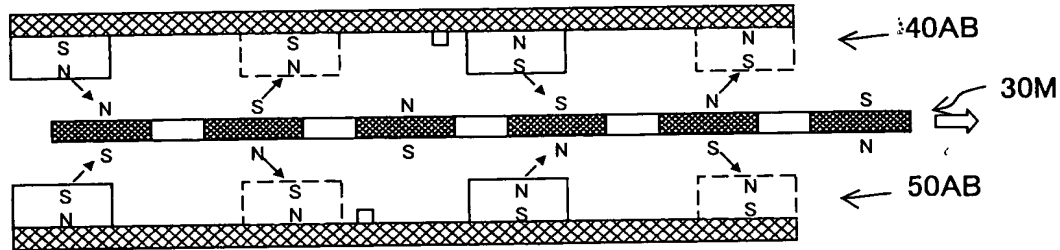


Fig.5(C)

Immediately before phase = $\pi/2$ (B-phase has polarity reversed at $\pi/2$)

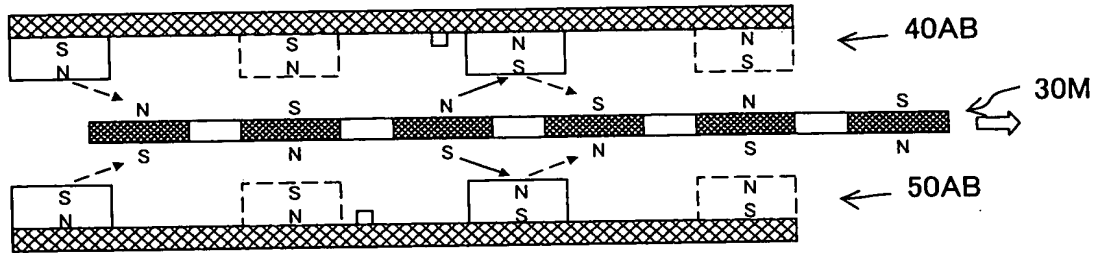
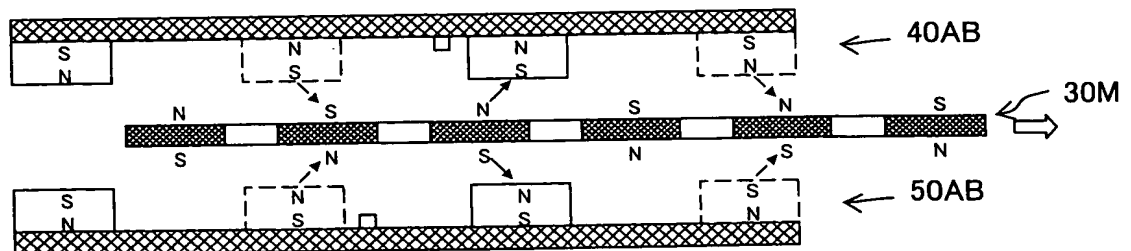


Fig.5(D)

Immediately before phase = $3\pi/4$



6/31

Fig.6(A)

Flat arrangement (example 1)

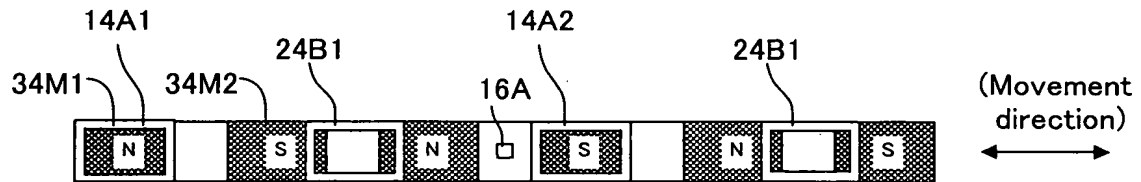
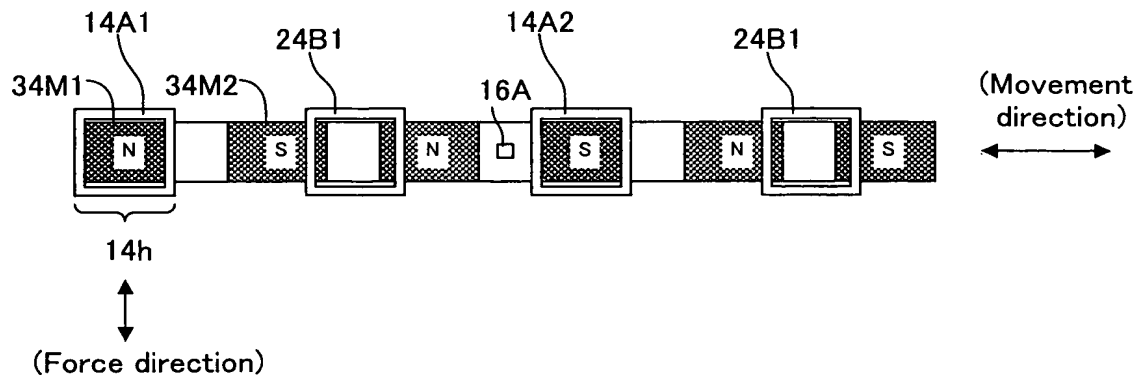


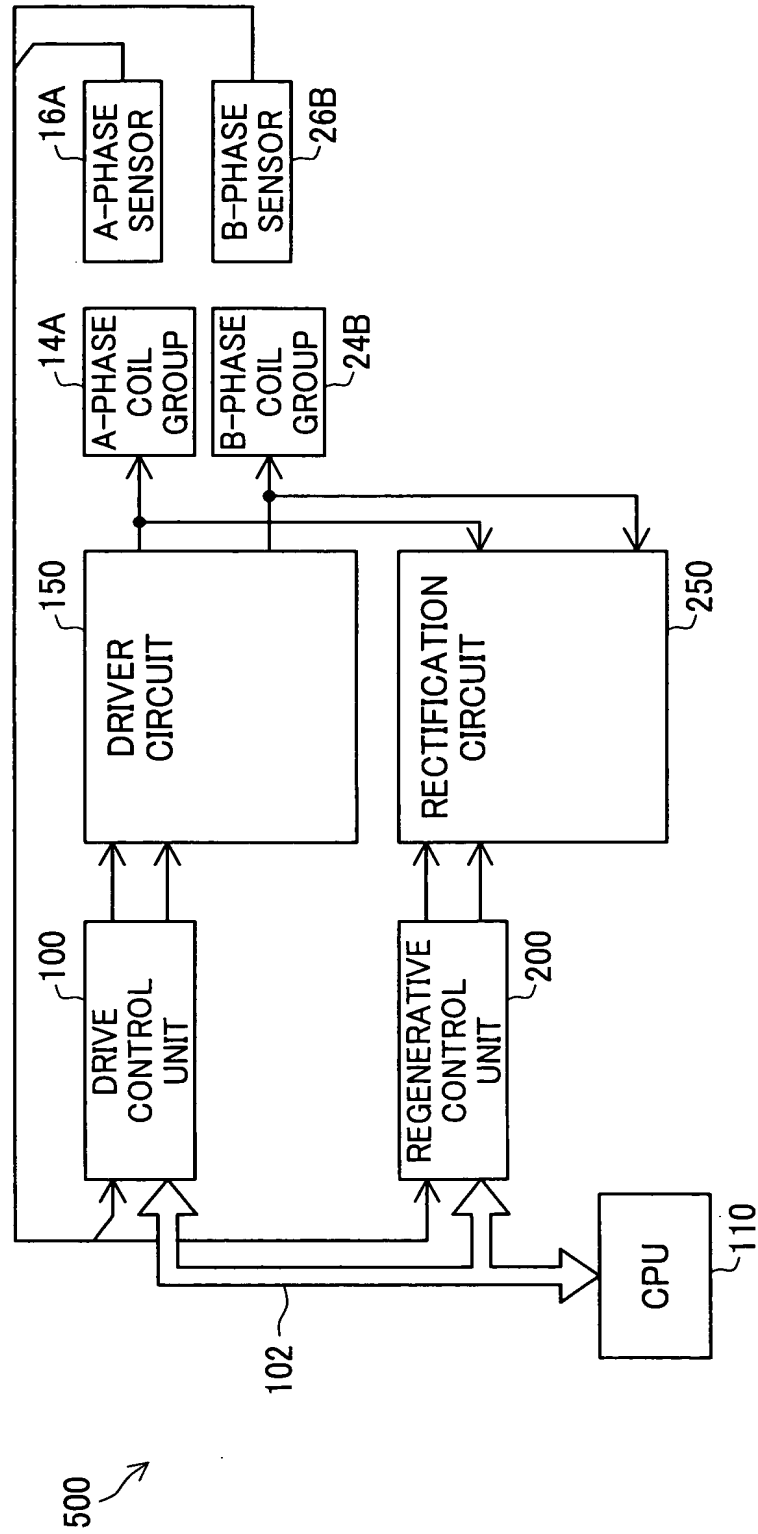
Fig.6(B)

Flat arrangement (example 2)

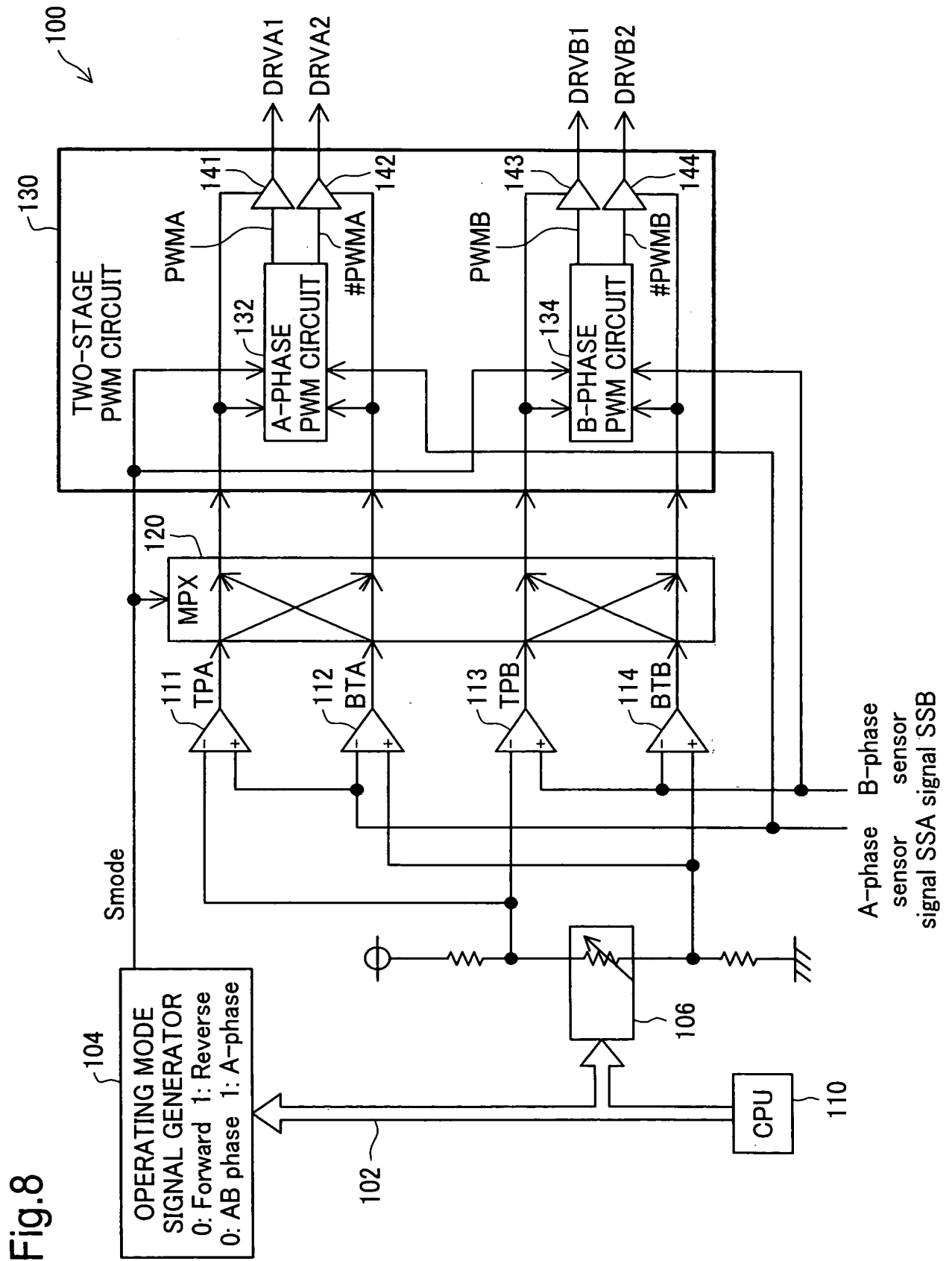


7/31

Fig.7

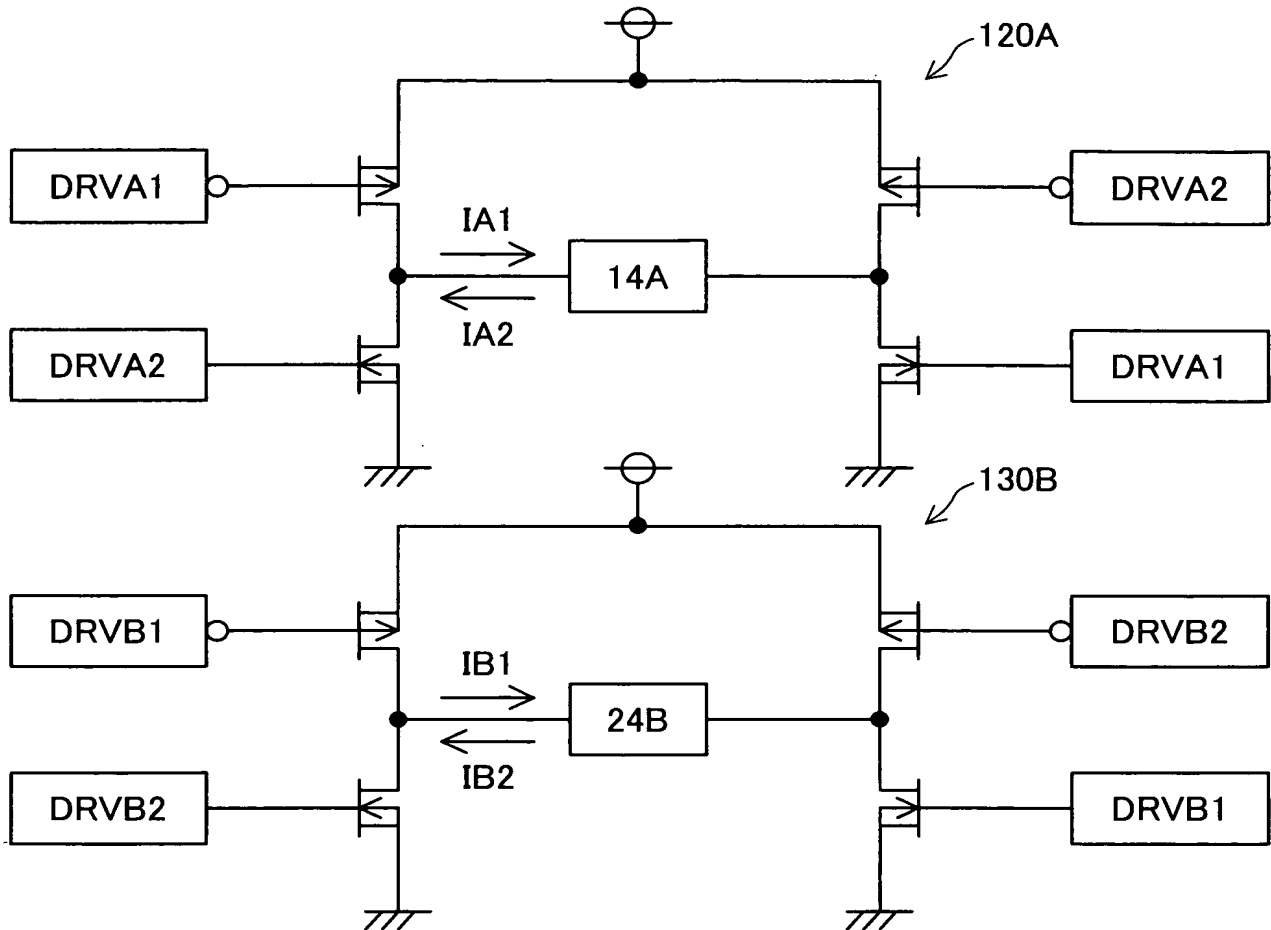


8/31



9/31

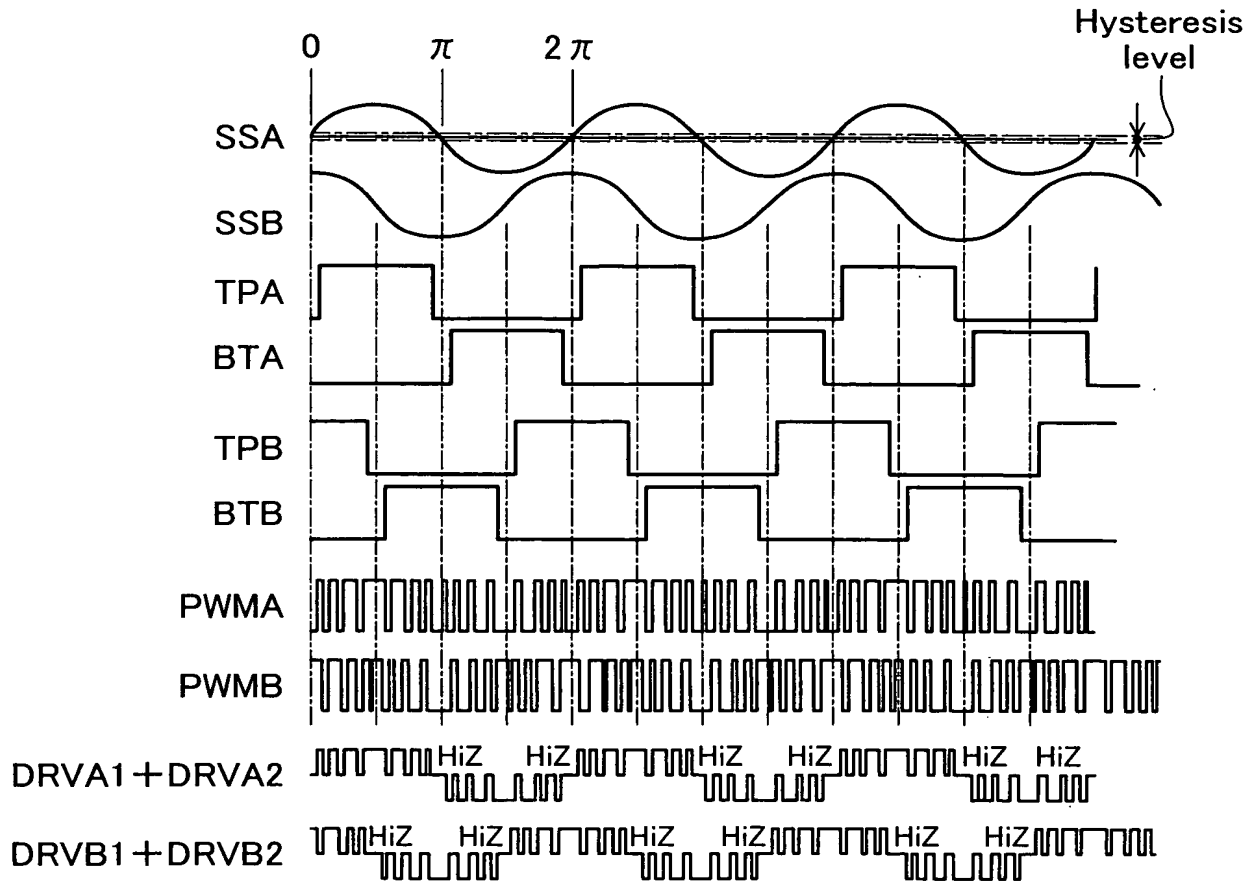
Fig.9



10/31

Fig.10

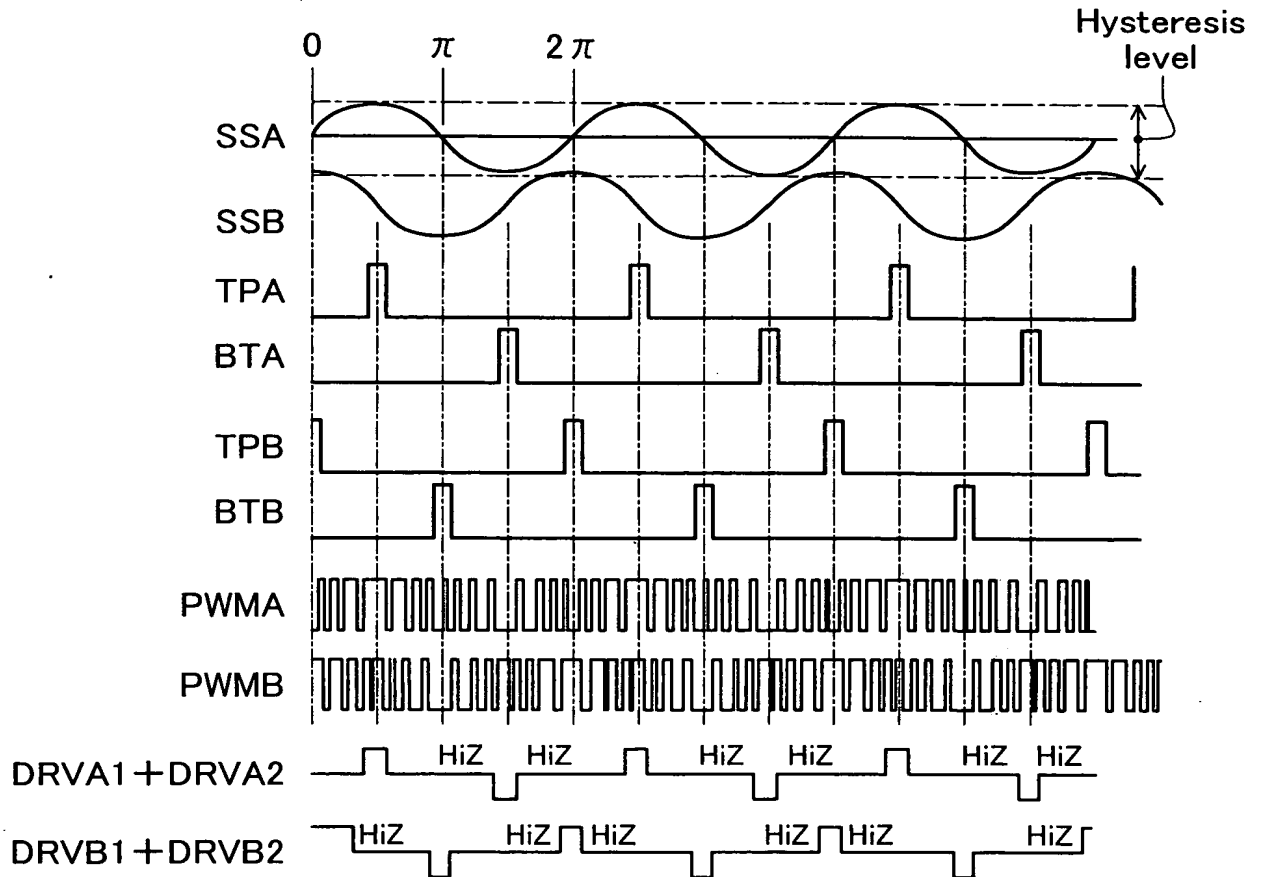
For large torque generation



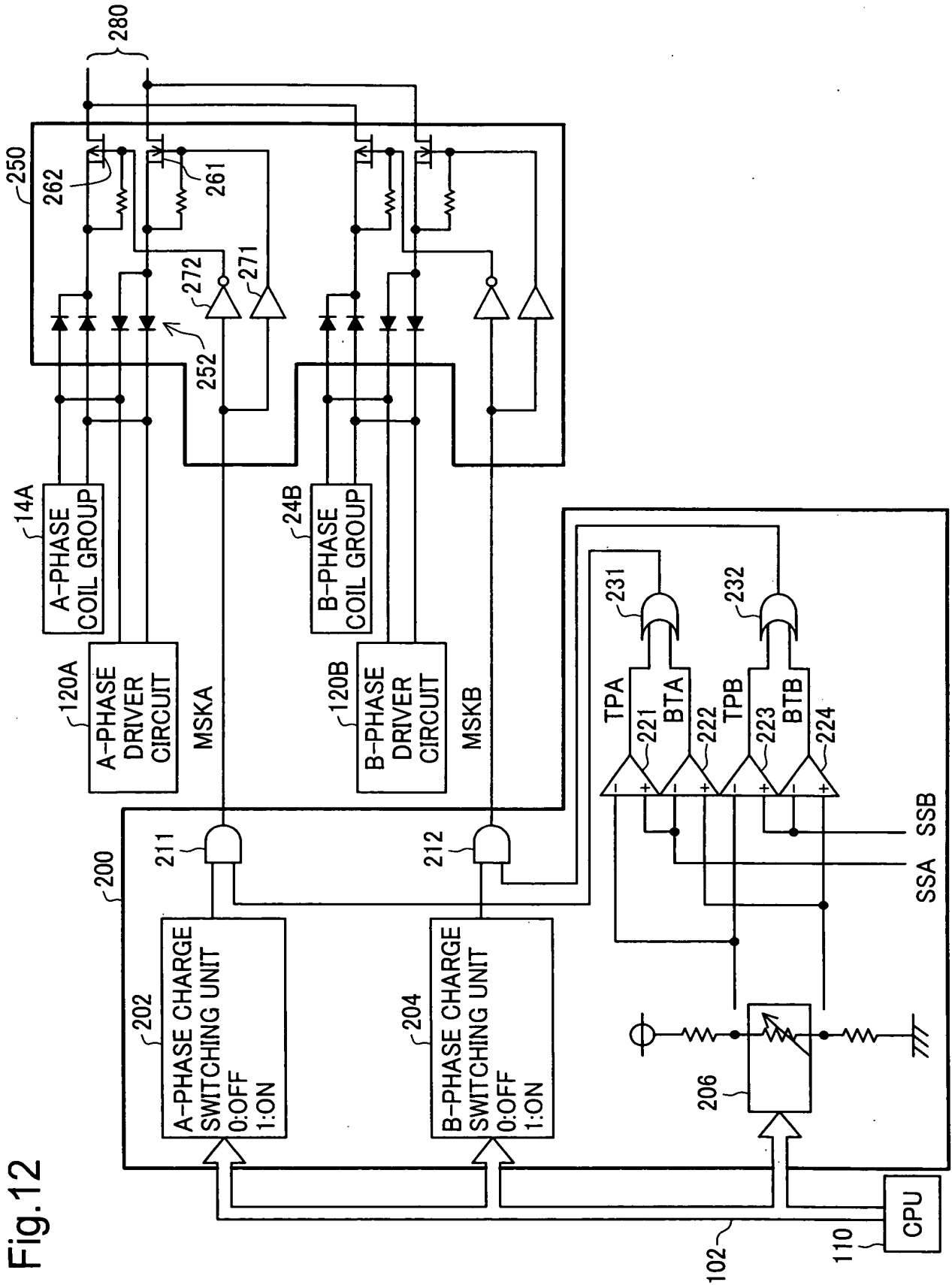
11/31

Fig.11

For small torque generation



12/31



13/31

Fig.13(A)

Two-phase motor first variation example

Immediately before phase = 2π (A-phase has polarity reversed at 2π)

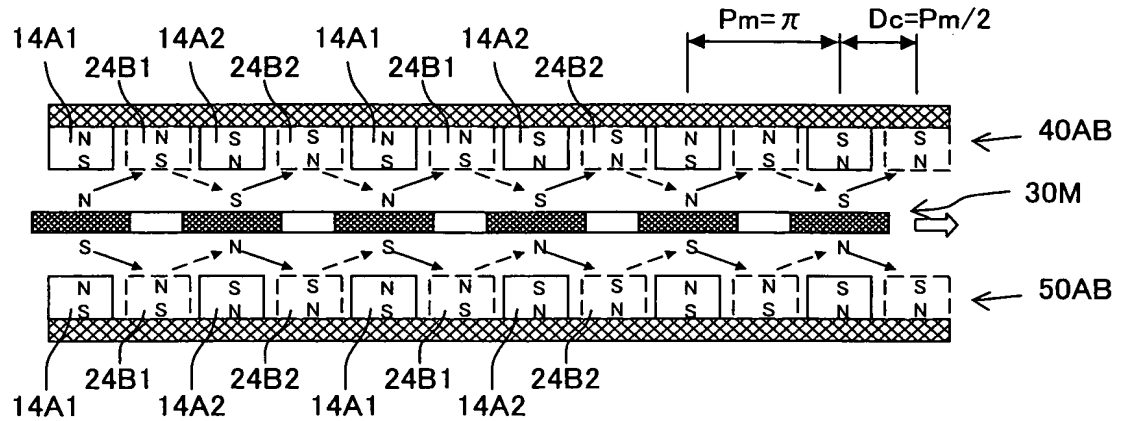


Fig.13(B)

Phase = $\pi/4$

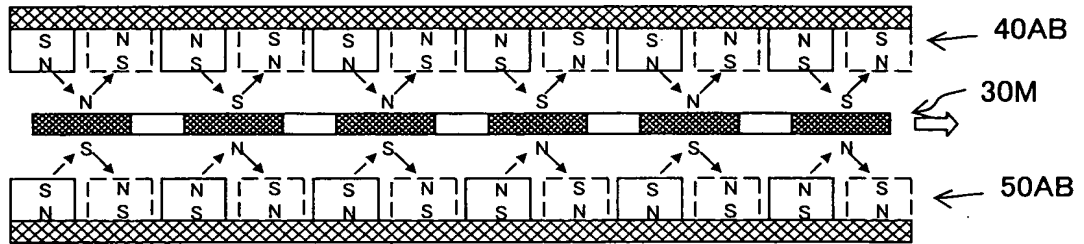


Fig.13(C)

Immediately before phase = $\pi/2$ (B-phase has polarity reversed at $\pi/2$)

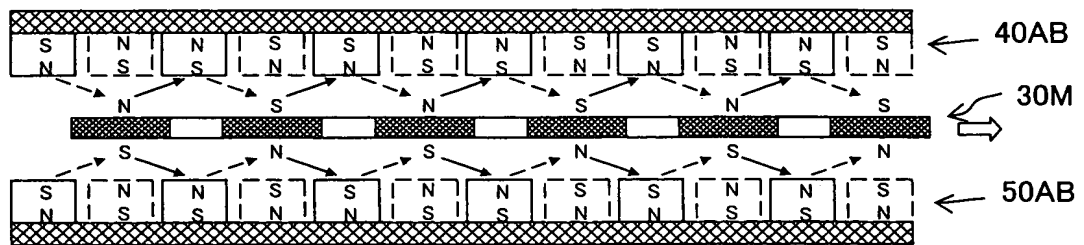
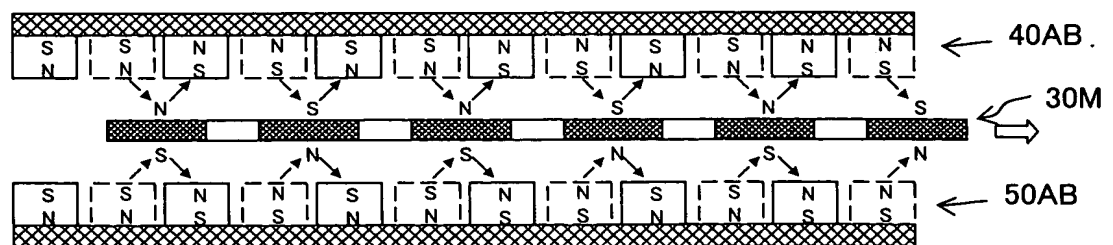


Fig.13(D)

Immediately before phase = $3\pi/4$



14/31

Fig.14(A)

Two -phase motor second variation example

Immediately before phase = 2π (A-phase has polarity reversed at 2π)

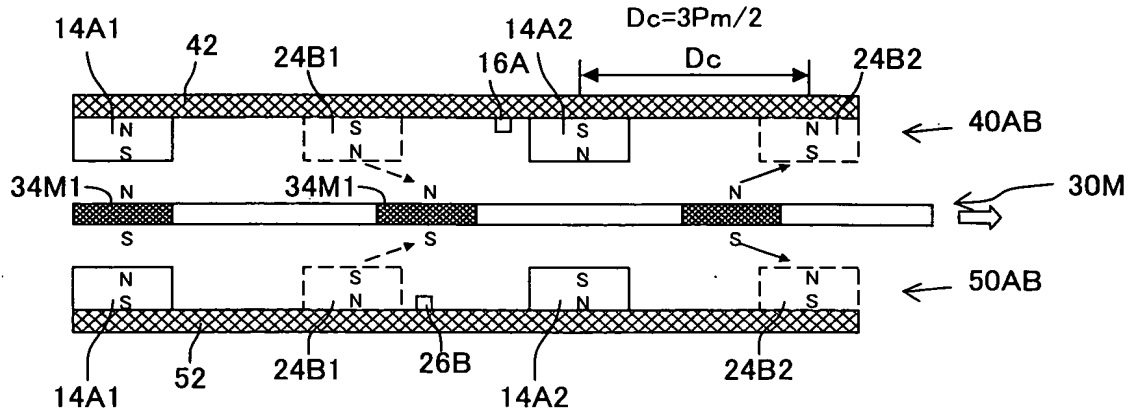


Fig.14(B)

Two -phase motor third variation example

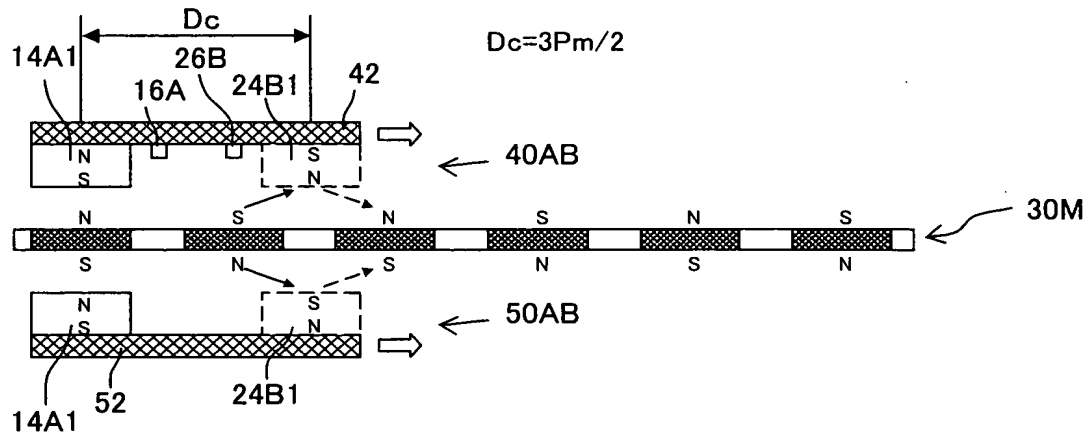
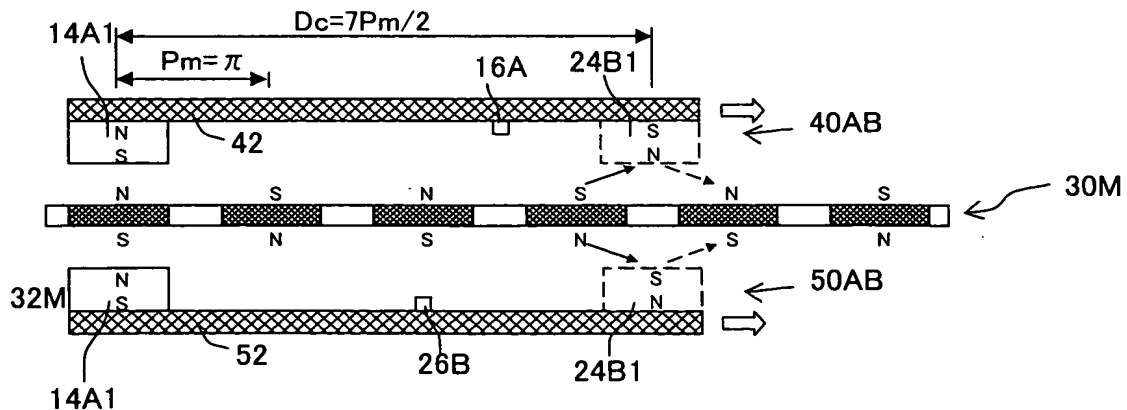


Fig.14(C)

Two -phase motor fourth variation example



15/31

Fig.15(A)

Two -phase motor fifth variation example (one sided arrangement)

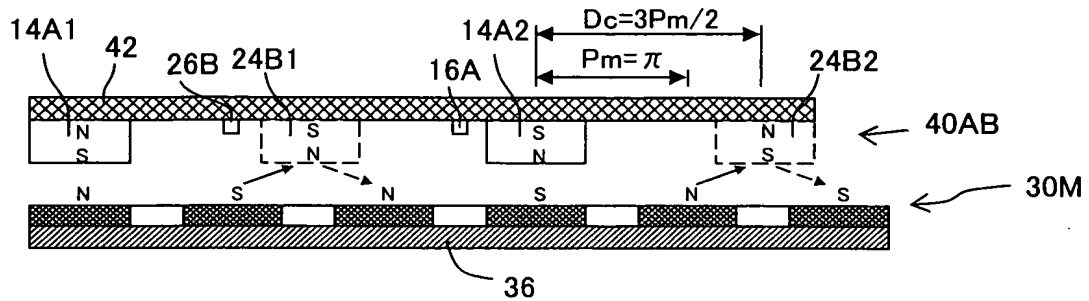
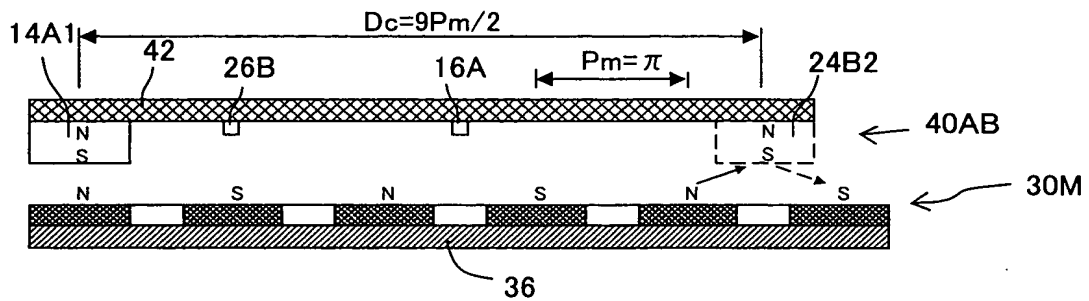


Fig.15(B)

Two -phase motor sixth variation example (one sided arrangement)



16/31

Fig.16

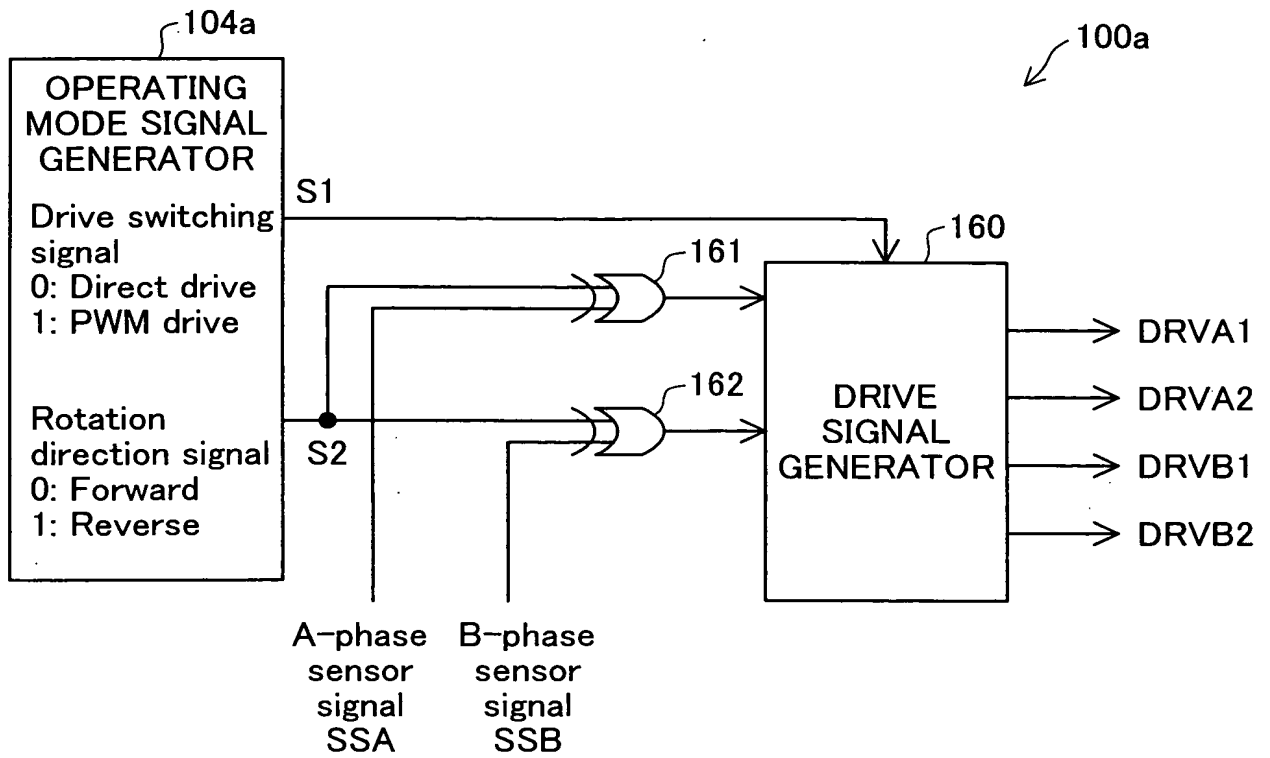
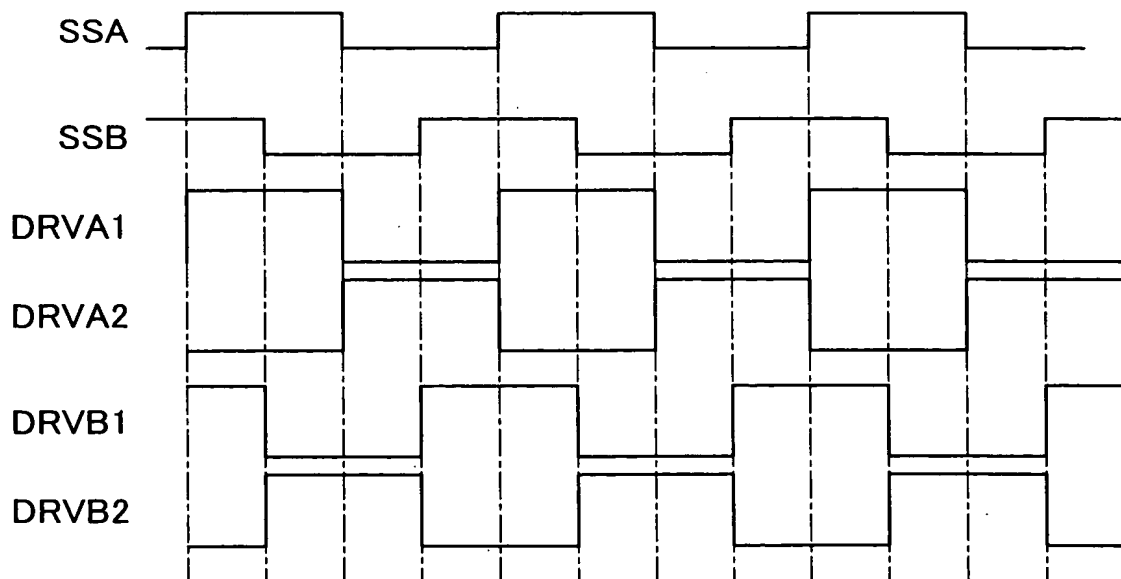


Fig.17



17/31

Fig.18

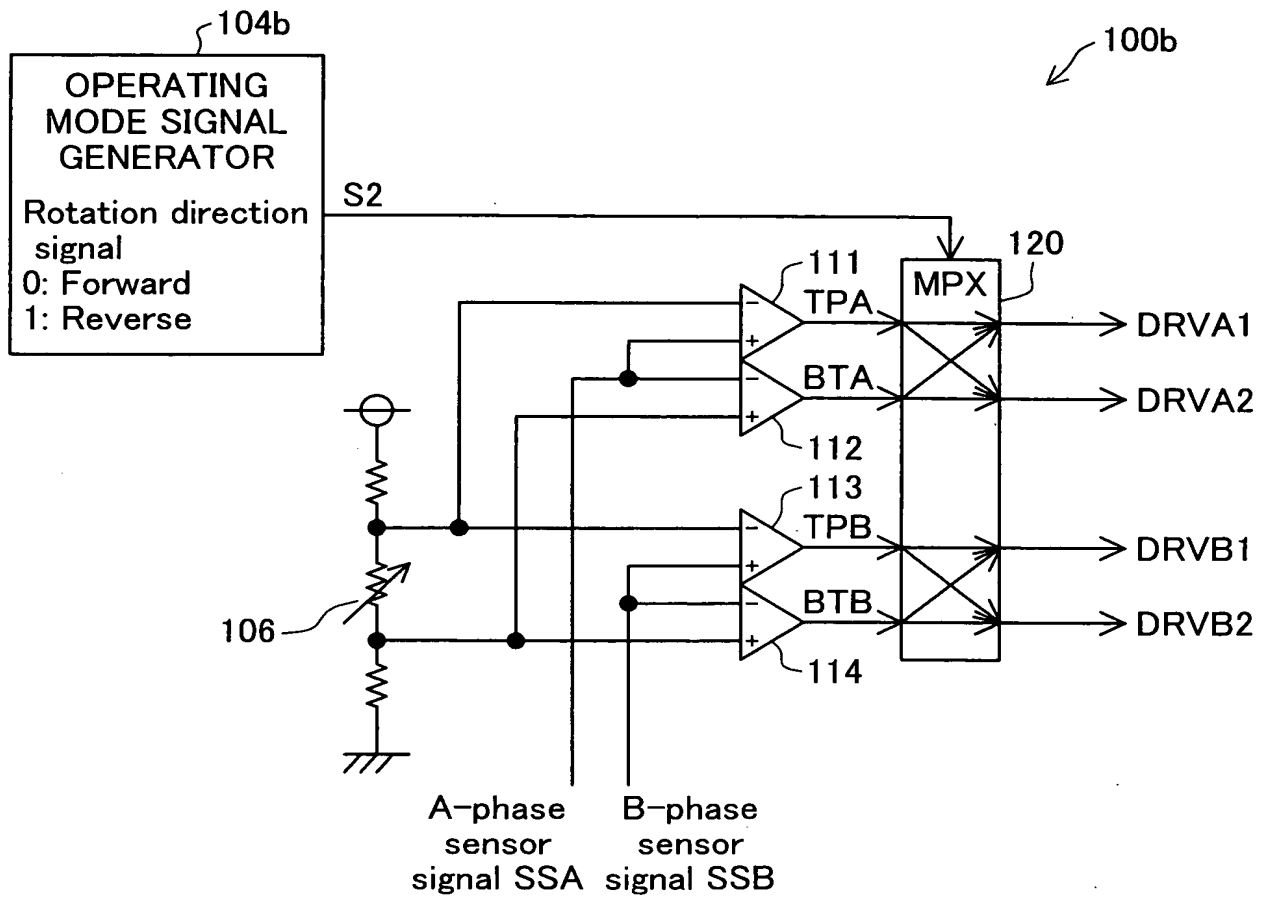
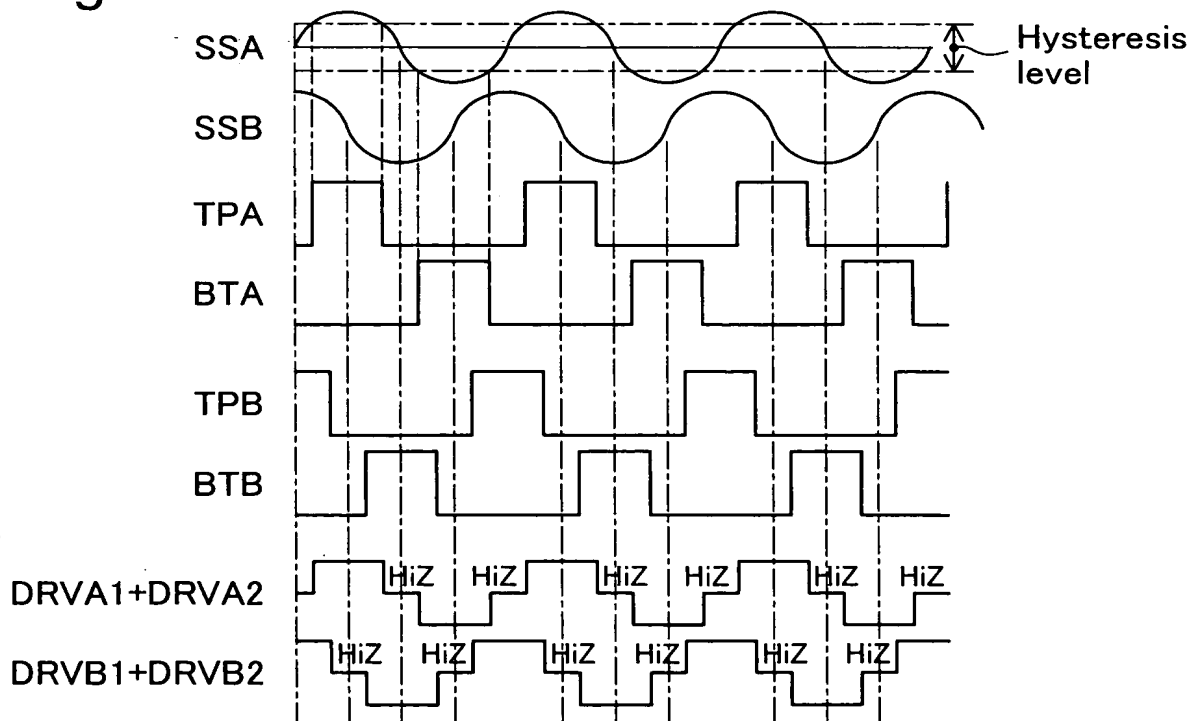
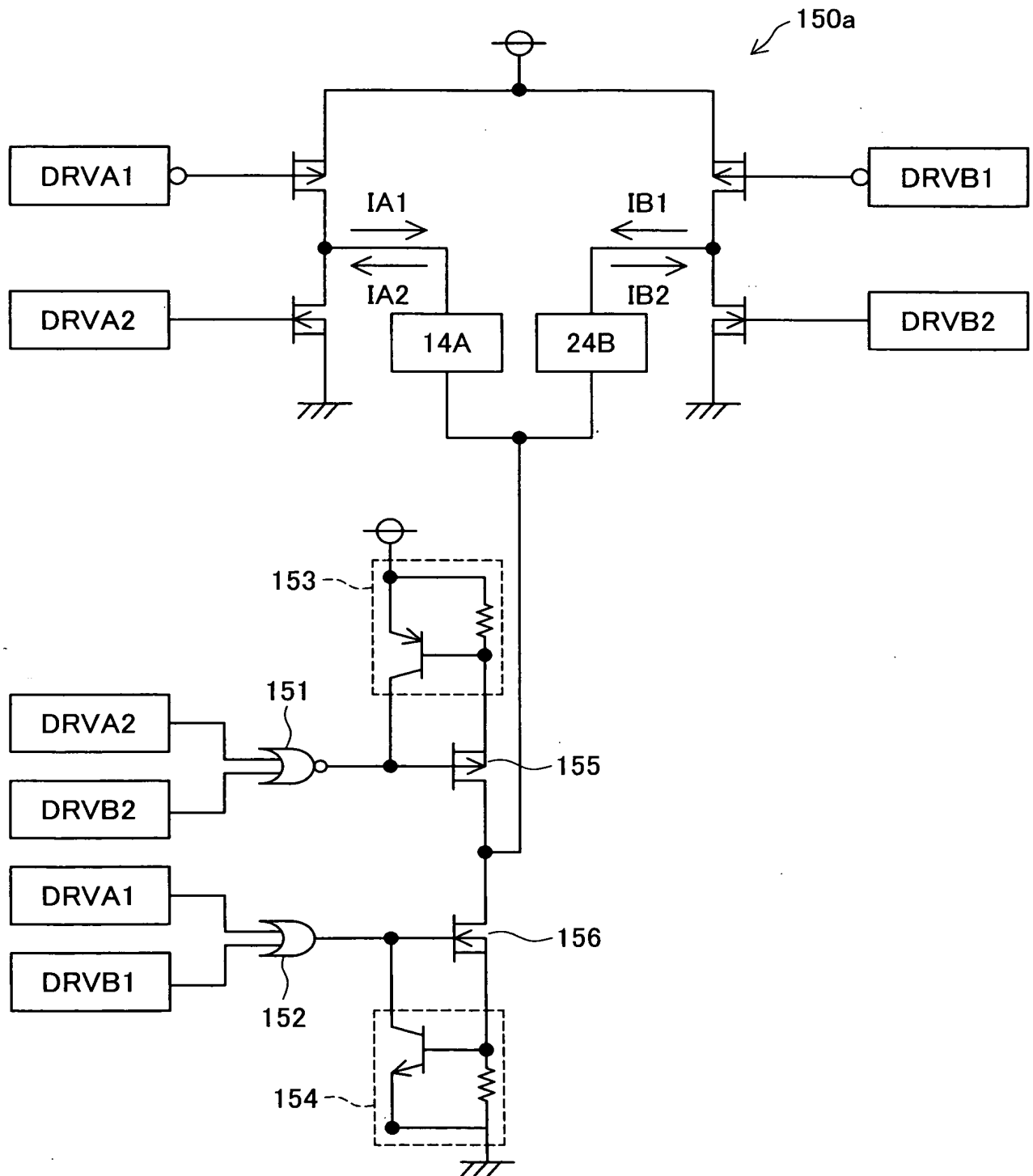


Fig.19



18/31

Fig.20



19/31

Fig.21(B)

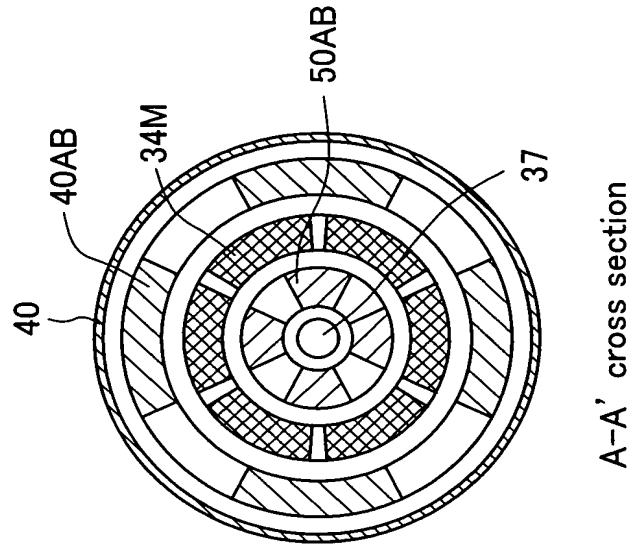
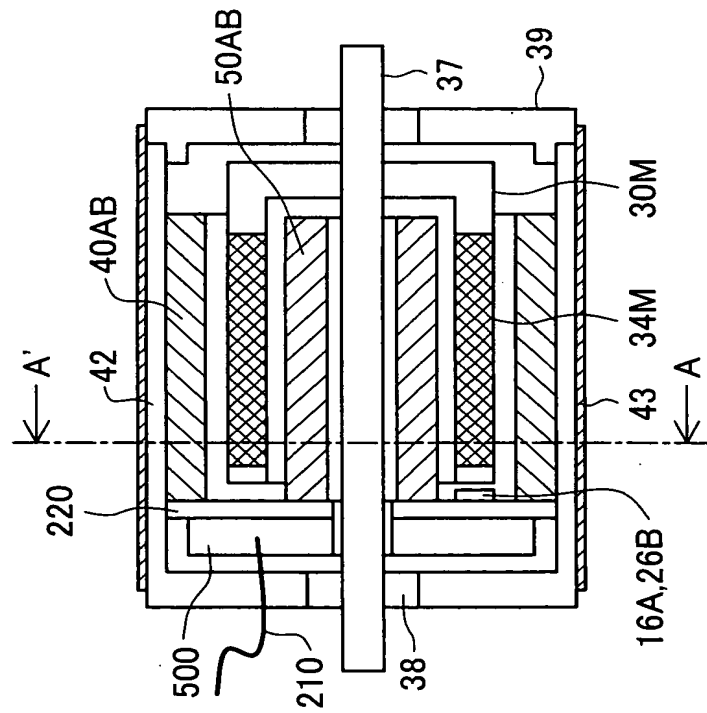


Fig.21(A)

Insert rotor structure (both sided arrangement)



20/31

Fig.22(B)

Rotor

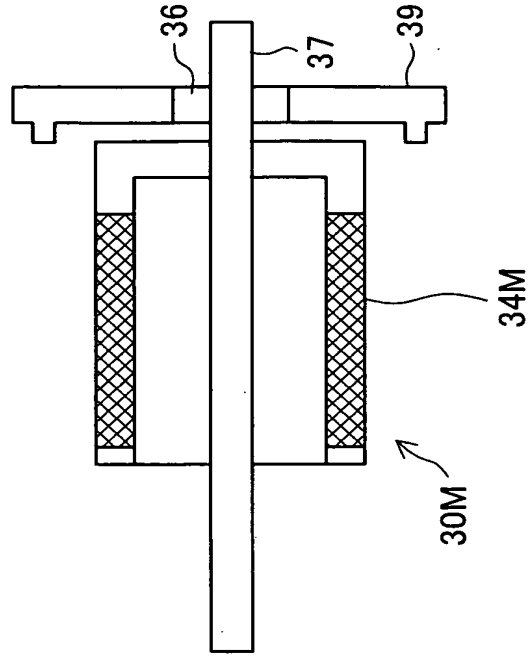
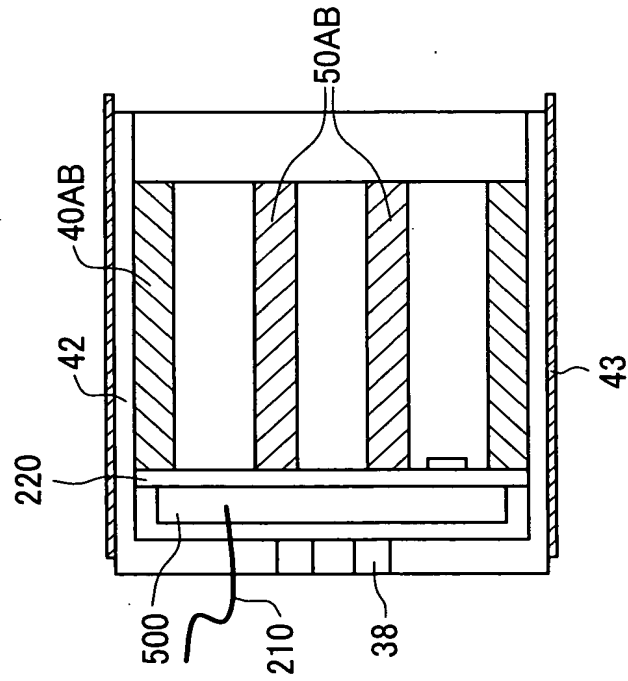


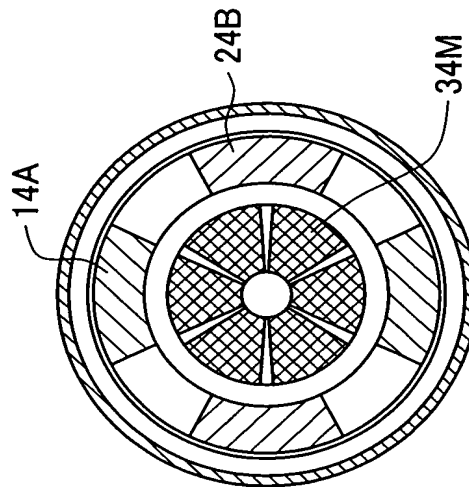
Fig.22(A)

Stator



21/31

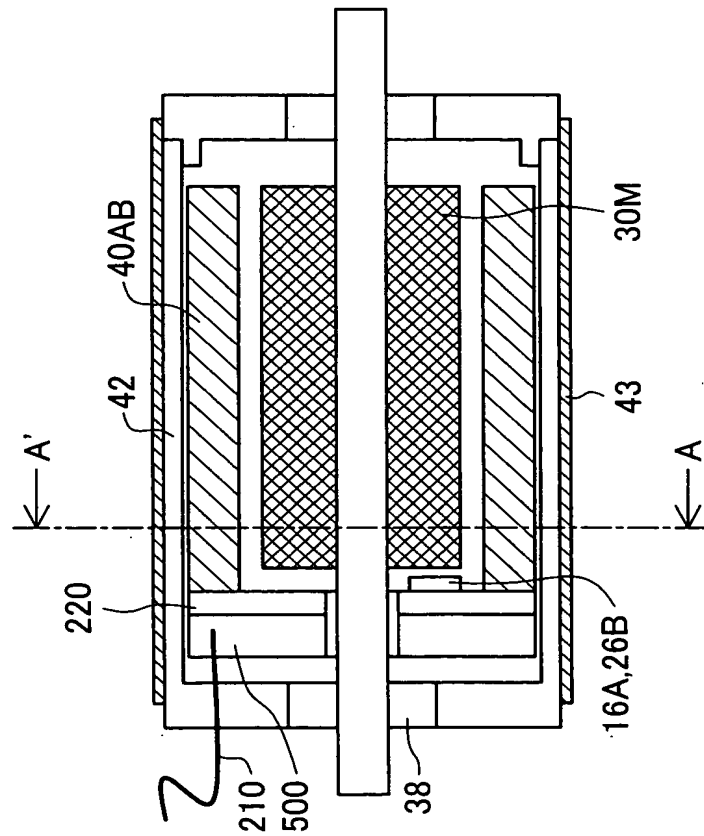
Fig.23(B)



A-A' cross section

Fig.23(A)

Inner rotor structure (one sided arrangement)



22/31

Fig.24(B)

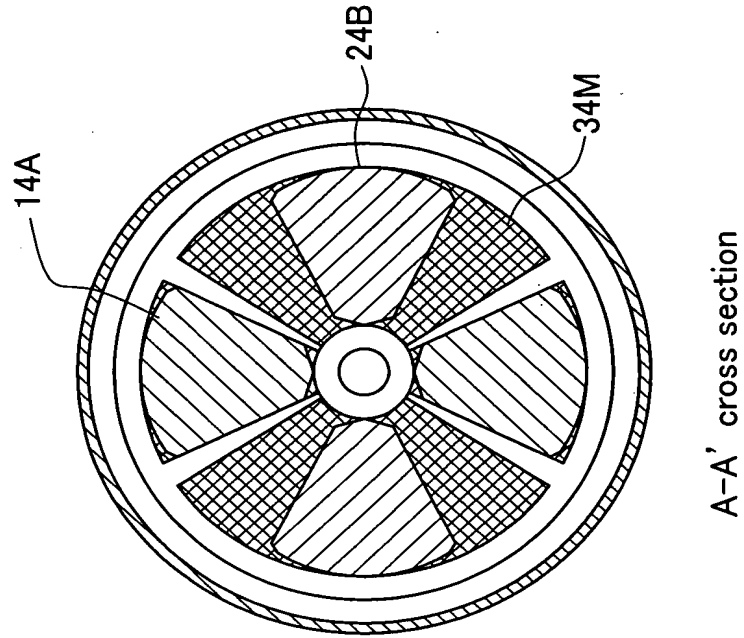
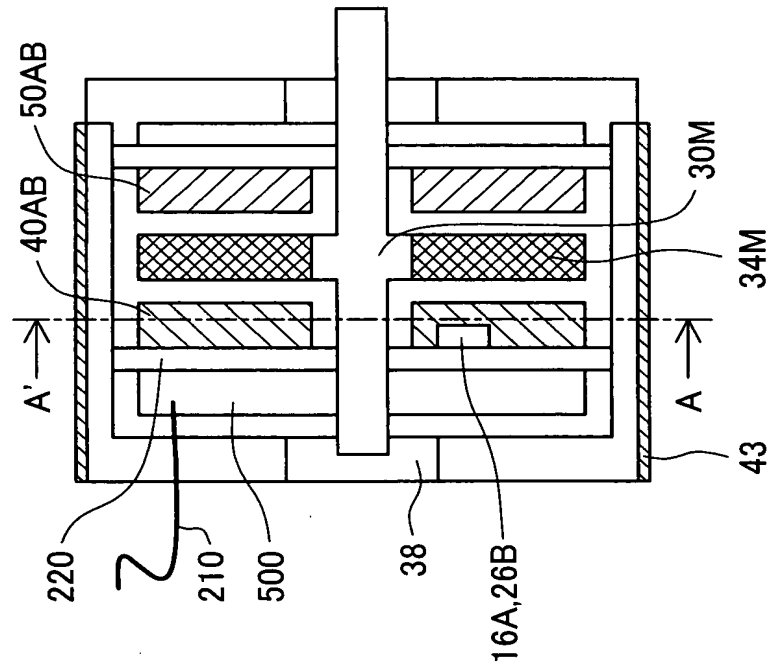


Fig.24(A)

Flat rotor structure (both sides arrangement)



23/31

Fig.25(B)

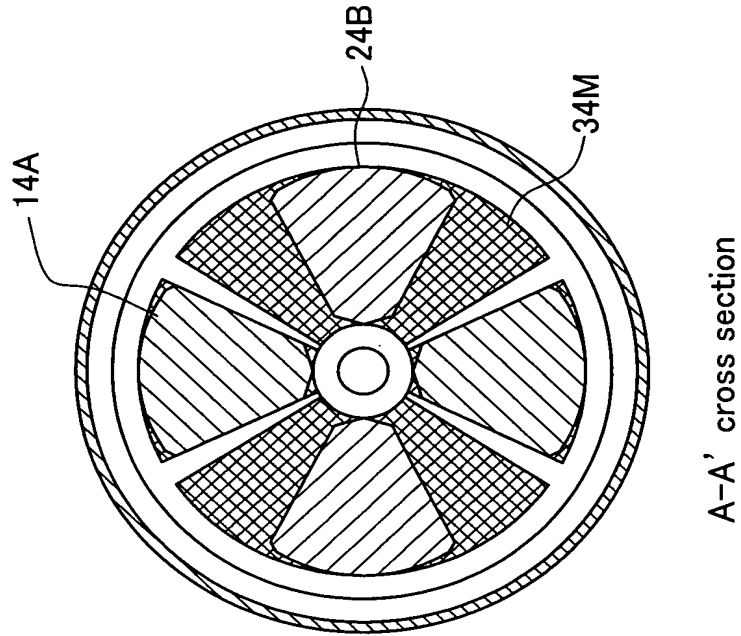
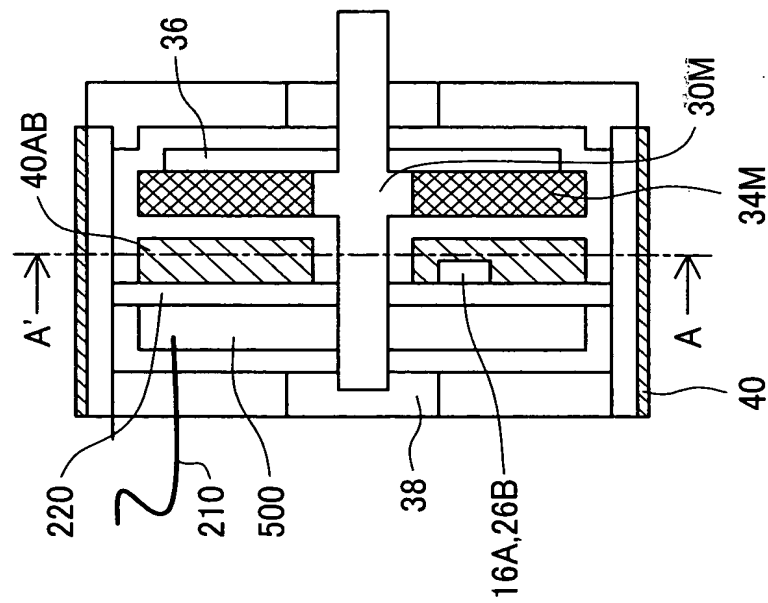


Fig.25(A)

Flat rotor structure (one sided arrangement)



24/31

Fig.26(A)

Second embodiment (three-phase motor)

Immediately before phase = 2π (A-phase has polarity reversed at 2π)

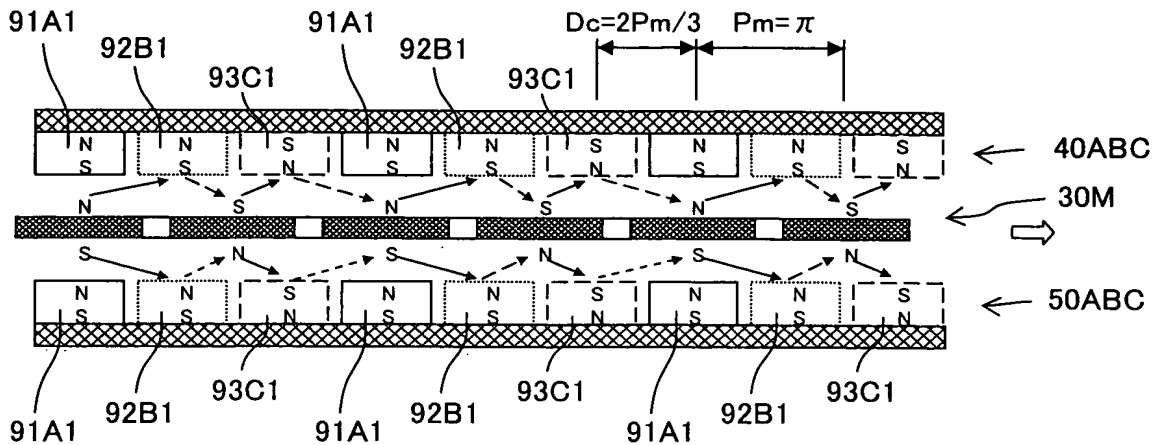


Fig.26(B)

Immediately before phase = $\pi/3$ (C-phase has polarity reversed at $\pi/3$)

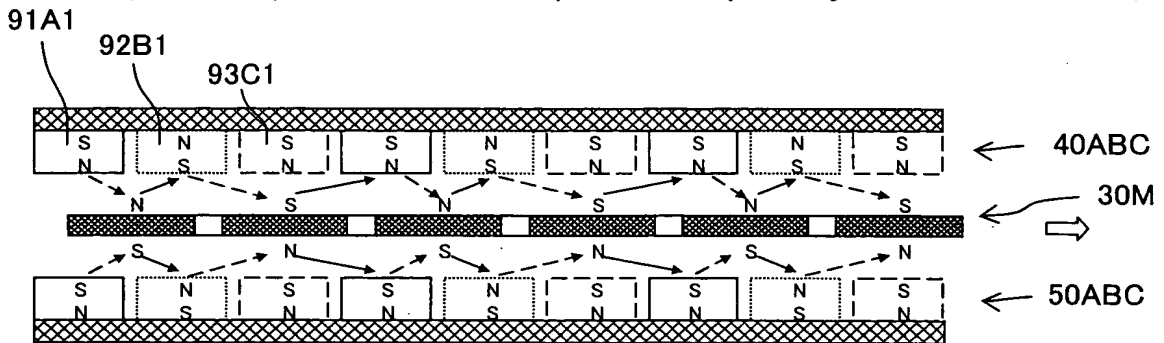
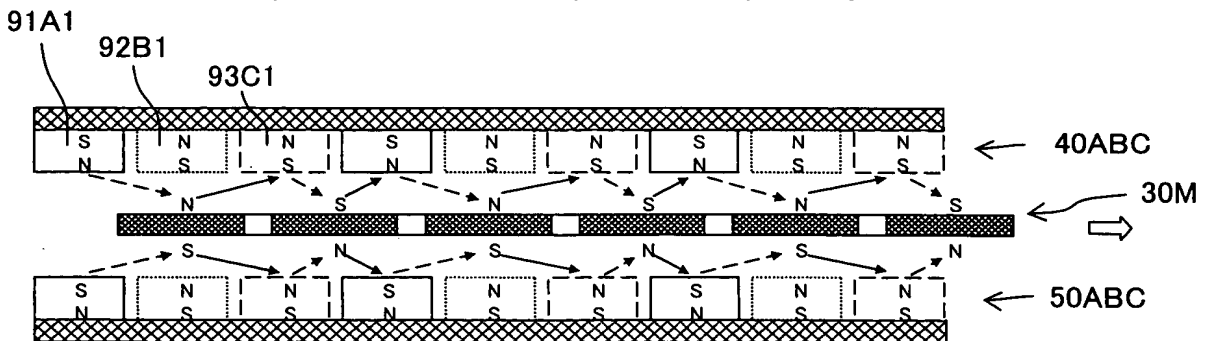
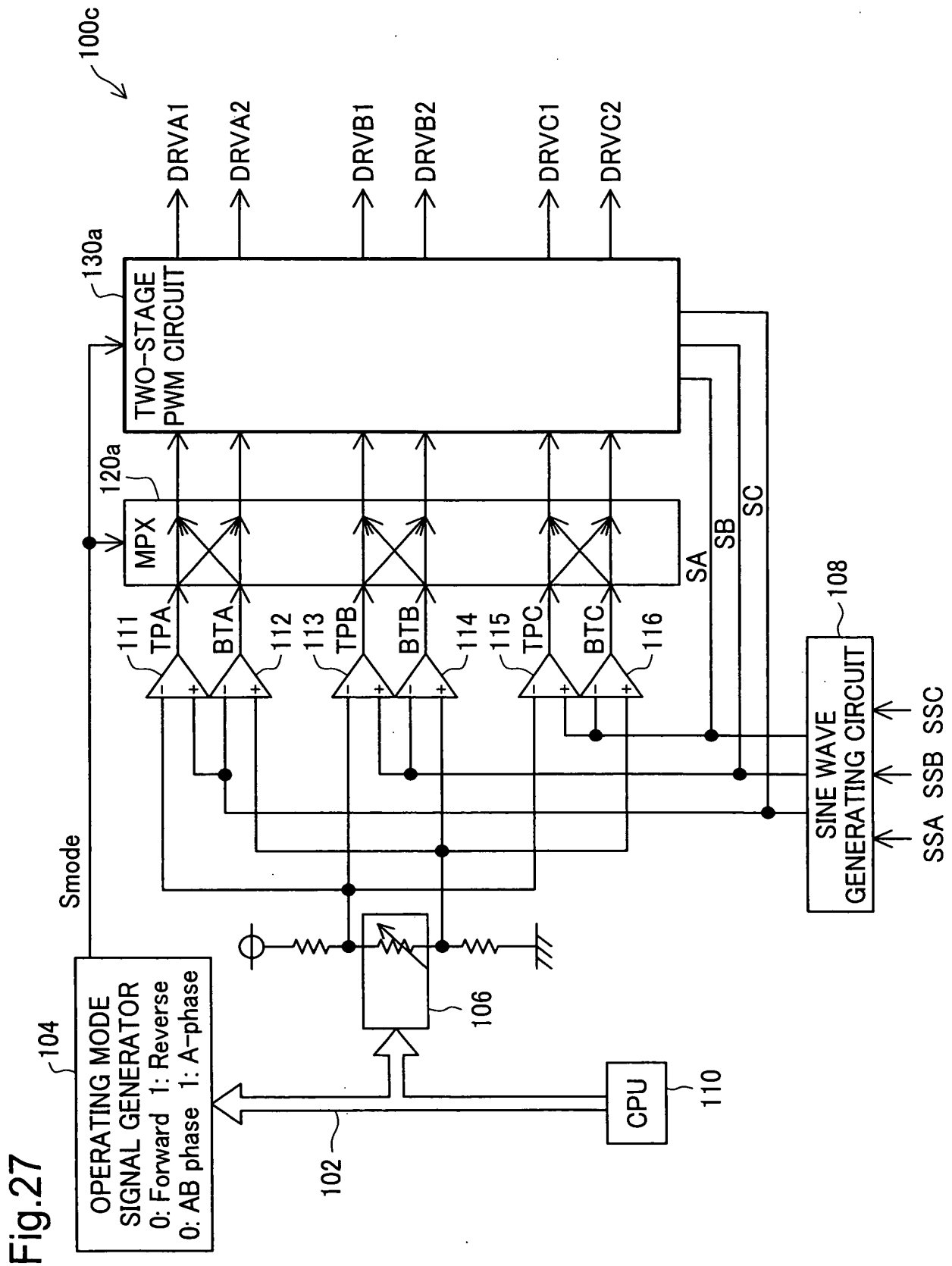


Fig.26(C)

Immediately before phase = $2\pi/3$ (B-phase has polarity reversed at $2\pi/3$)

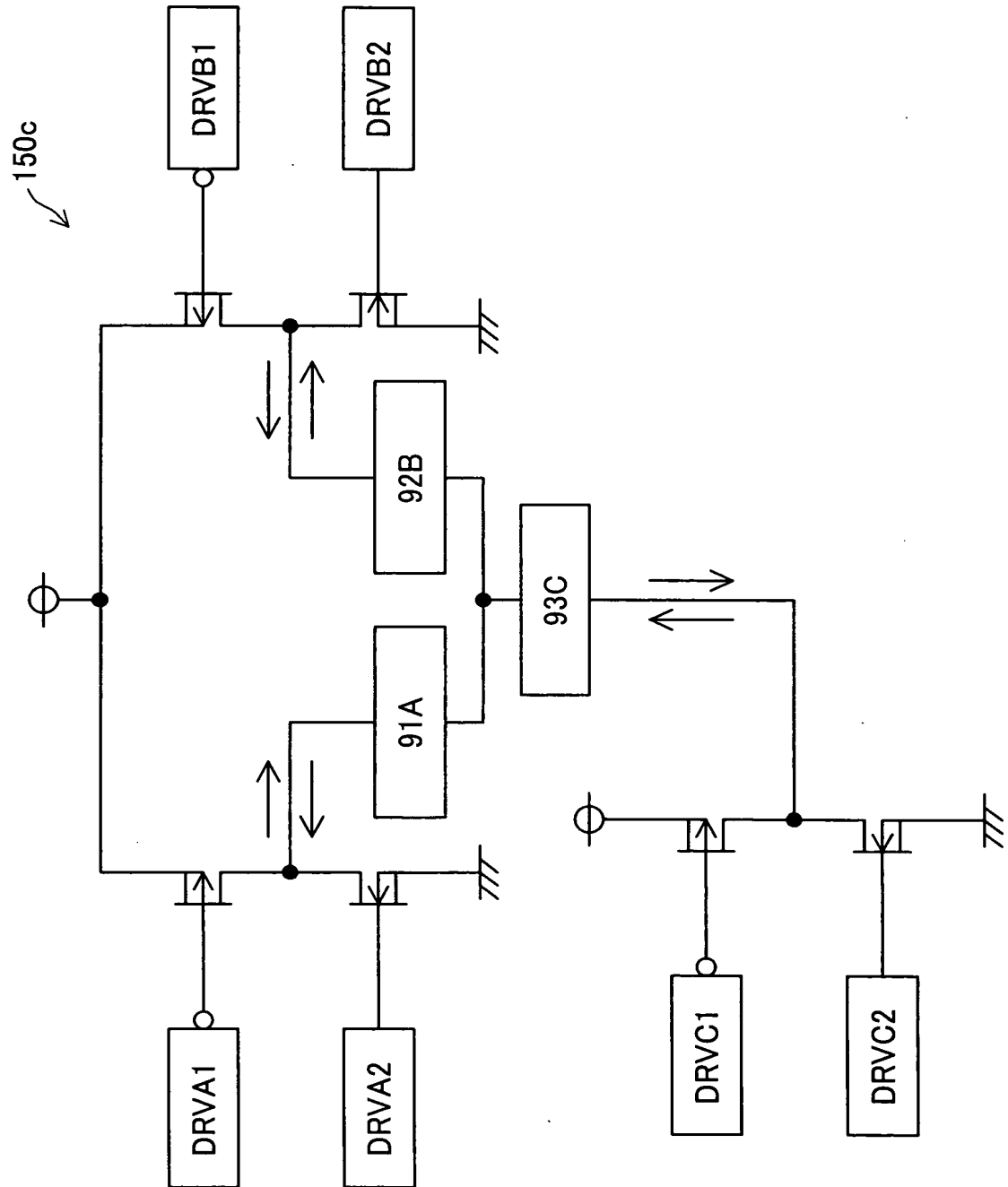


25/31



26/31

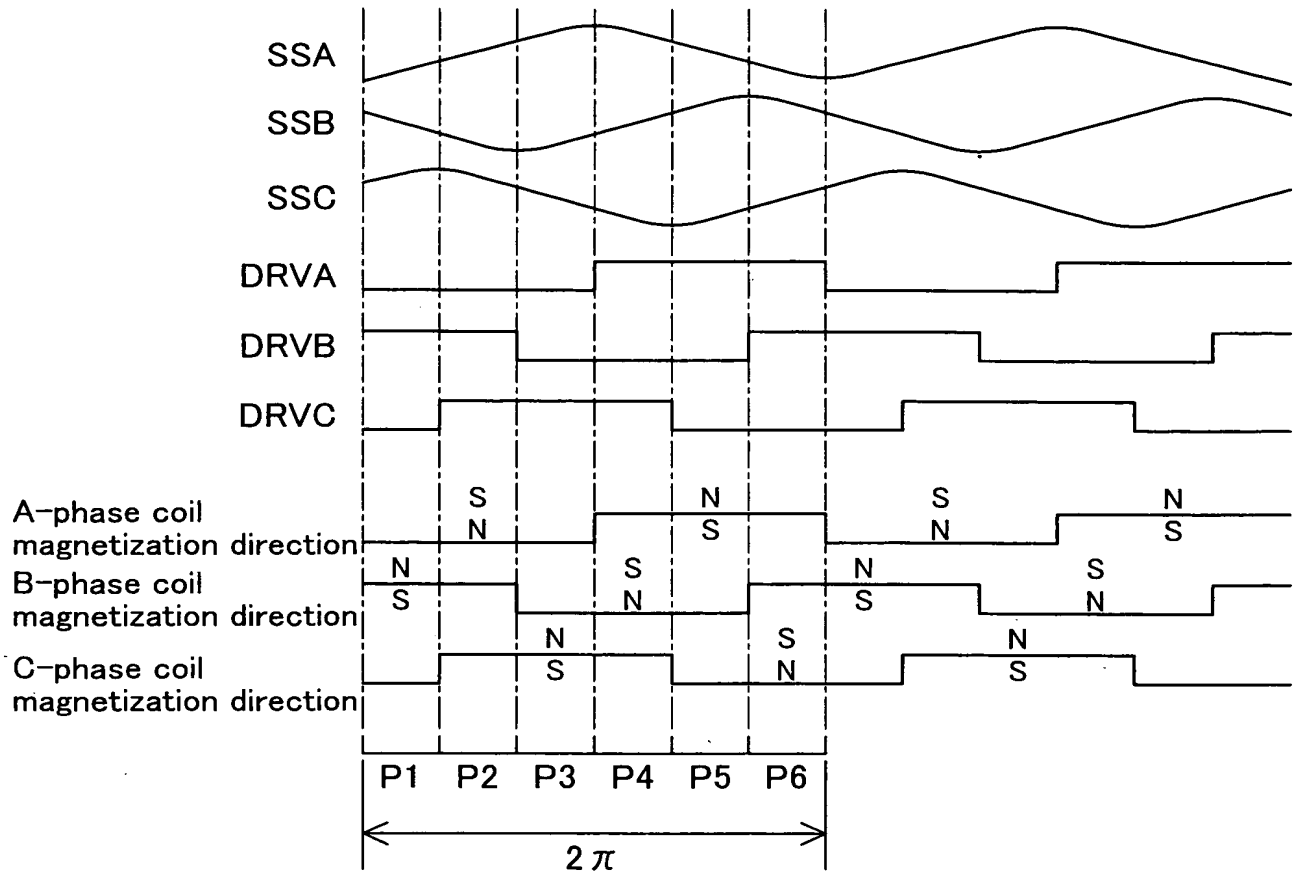
Fig.28



27/31

Fig.29

Three-phase timing chart



28/31

Fig.30(A)

Period P1

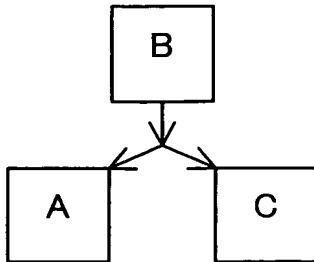


Fig.30(B)

Period P2

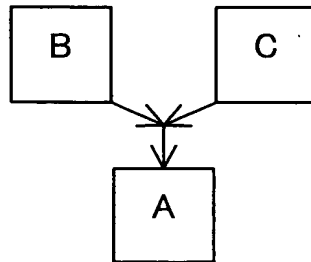


Fig.30(C)

Period P3

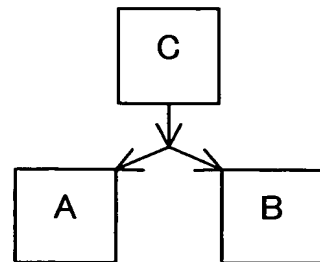


Fig.30(D)

Period P4

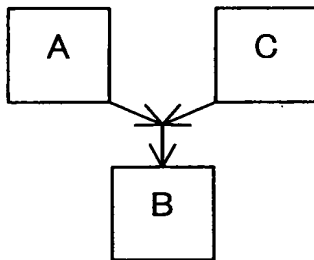


Fig.30(E)

Period P5

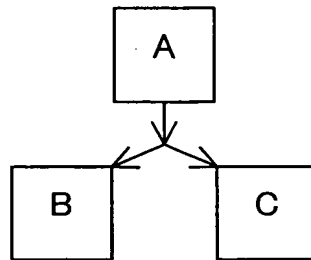
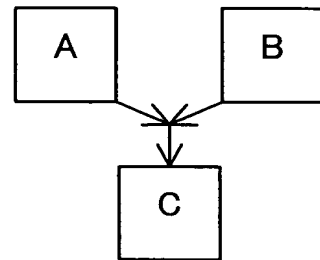


Fig.30(F)

Period P6



29/31

Fig.31(A)

Third embodiment (four-phase motor)

Immediately before phase = 2π (D-phase has polarity reversed at 2π)

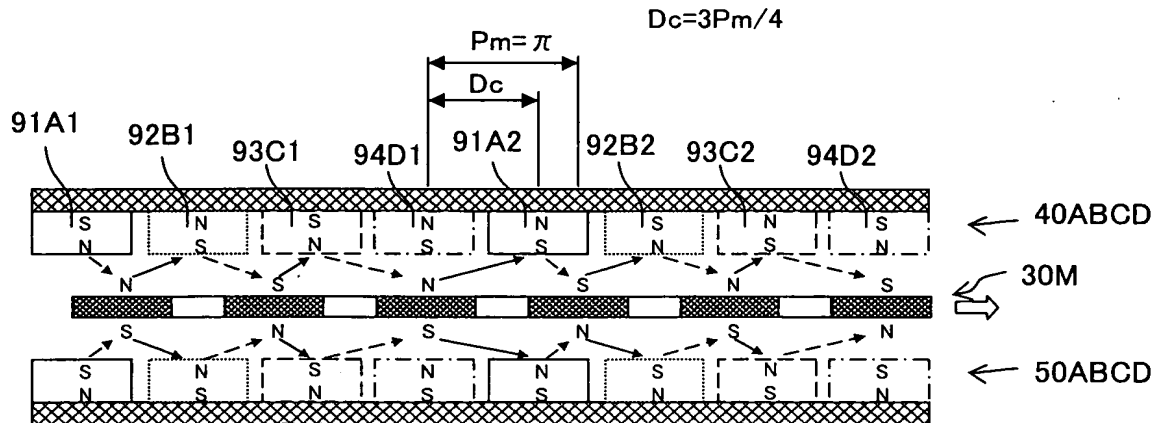


Fig.31(B)

Immediately before phase = $\pi/4$ (C-phase has polarity reversed at $\pi/4$)

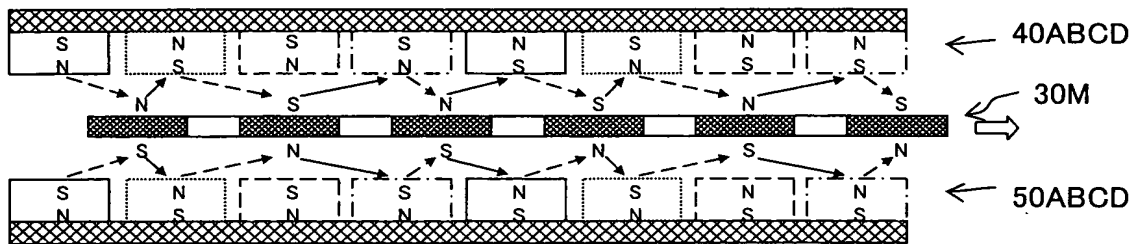


Fig.31(C)

Immediately phase = $\pi/2$ (B-phase has polarity reversed at $\pi/2$)

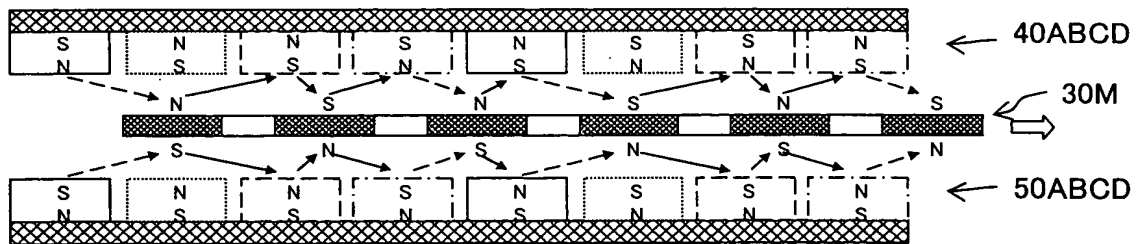
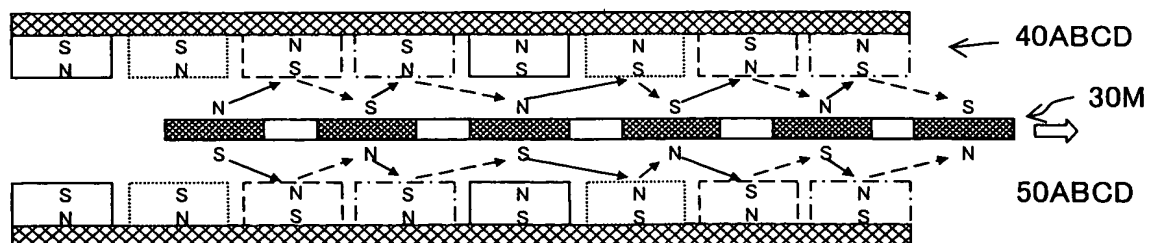


Fig.31(D)

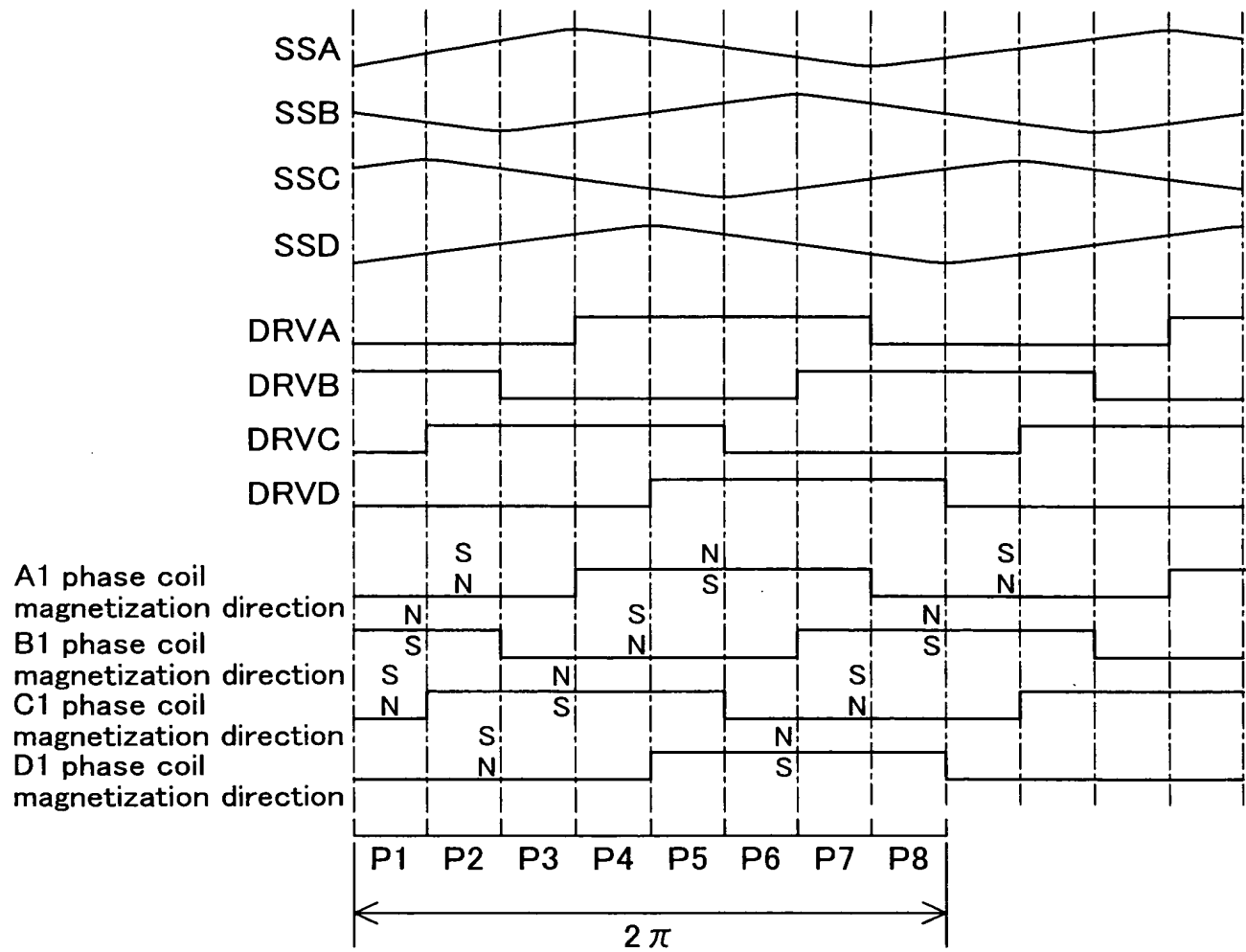
Immediately before phase = $3\pi/4$ (A-phase has polarity reversed at $3\pi/4$)



30/31

Fig.32

Four-phase timing chart



31/31

Fig.33(A)

Flat ring shaped coil

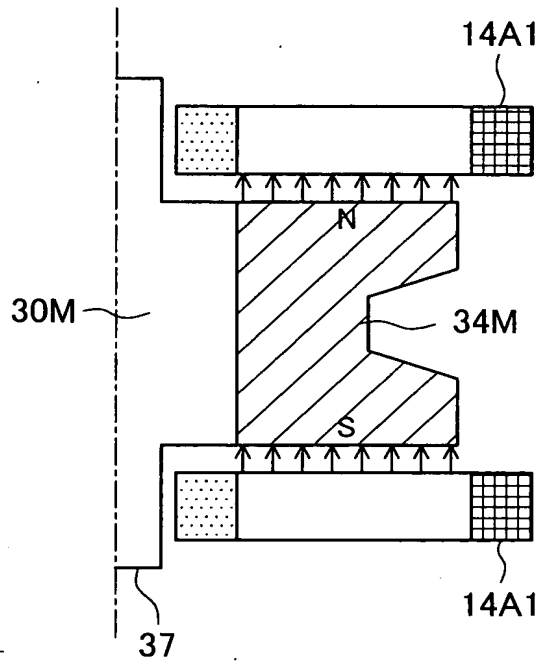


Fig.33(B)

Bent ring shaped coil

